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CRIMSON CLOVER: UTILIZATION.

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INTRODUCTION.

Crimson clover may be utilized in a number of different ways. For feeding purposes it may be used as a soiling crop, hay, ensilage, and pasture for all classes of live stock. In addition, it is of special value as a green-manure crop to increase the humus and nitrogen content of the soils upon which it is produced. When cut for hay the stubble and roots remain in the soil, and when pastured the uneaten parts of the plants, as well as the manure made while the cattle are being pastured, are added to the soil for the benefit of the succeeding crops. Also when cut for seed the stubble and roots remain, and, if desired, the straw can be scattered back on the land to further increase its fertility. Crimson clover is also of some value as a honey plant, furnishing an abundant supply of nectar for a short period in the spring.

One disadvantage of crimson clover is the comparatively short period in the spring during which it may be utilized. This drawback can be overcome materially by the seeding of both late and early strains, in addition to the ordinary variety. In this way the season for cutting either the hay or green feed is lengthened. Plowing under for green manure is a time-consuming process, and the use of varieties having different dates of maturity would enable the farmer to utilize a much larger acreage for this purpose. The white-blooming, white-seeded strain is from two to three weeks later than the ordinary crimson variety.¹

¹ A discussion of the growing of crimson clover, the preparation of the seed bed, soils and sections adapted to this crop, etc., will be found in Farmers' Bulletin 550, entitled "Crimson Clover: Growing the Crop," copies of which may be procured free of cost by addressing the Secretary of Agriculture, Washington, D. C.

NOTE.—This publication gives time of cutting, methods of harvesting, feeding value, and use as a soiling crop, as pasture, as a soil improver, and as a cover crop. Adapted to the Eastern States.

CRIMSON-CLOVER HAY.**TIME OF CUTTING.**

In order to obtain the best hay, crimson clover should be cut when the most advanced heads are beginning to show faded flowers at their base. At this stage the plants contain the maximum amount of protein and dry matter, while the leaves are still present and the stems are comparatively green. The chief danger of later cutting is owing to the fact that the short hairs on the stems and flower heads soon become dry and stiff and in this state are more likely to form



FIG. 1.—Tedding crimson-clover hay shortly after being cut. In the background the hay is being bunched or shocked with pitchforks.

hard hair balls in the intestinal tracts of horses to which the hay may be fed. If cut before the full-bloom stage, less than the maximum quantity is obtained and the hay is somewhat more difficult to cure.

HARVESTING.

Crimson clover for hay should be mown after the dew is off in the morning and allowed to lie in the swath for a few hours. It should then be tedded at least twice, with an interval of about six hours of sunshine between the different tedding operations. (See fig. 1.) The hay will then be in a condition to rake into windrows. (See fig. 2.)

After lying in the windrow for a day of good drying weather, the hay can be placed in small shocks, where it will cure nicely in three or four days unless rain should intervene. It ordinarily requires

about a week from the time the hay is cut until it can be safely placed in the barn. For the best results in curing, both the ground



FIG. 2.—Raking crimson-clover hay. After being teded once or twice the hay is raked into windrows and later placed in large bunches or shocks.

and the air should be warm and dry. The hay should not be hauled to the barn until it is dry enough to rattle when handled with the fork. (See fig. 3.)



FIG. 3.—Hauling crimson-clover hay to the barn. This hay had been cut five days previously.

It is important in curing crimson-clover hay that the leaves be not allowed to become so dry as to crumble in either the swath or

windrow. Crumbling leaves result in a very dusty hay, as well as in much loss.

Rain is somewhat less harmful to crimson clover in the shock than to other forms of clover or alfalfa, but, nevertheless, it is subject to a good deal of leaching if exposed to the rain. This leaching action of the rain dissolves the more soluble portions of the hay, such as some of the protein, sugars, etc. Analyses of samples of crimson-clover hay were made by the Bureau of Chemistry of the United States Department of Agriculture. One sample was subjected to water from a sprinkler, to imitate three successive rains of one hour each at intervals of three days. A duplicate sample gathered at the same time and under the same conditions was not subjected to water falling upon it during the process of curing. The analyses showed that the sample which had been subjected to the artificial rain had lost about three-fourths of its sugar, one-ninth of its protein, and three-fourths of its mineral constituents. The percentage of protein in the unleached sample was 14.88, as compared with 13.19 for the leached sample.

If untimely rains wet into the shocks for a considerable depth, it is the practice in some sections to remove the top third and place it to one side instead of pulling the shock to pieces. The remaining part of the shock is then inverted and the old top again placed in position on the old base of the shock, which has become the top. This permits a sufficiently rapid drying out of the shock without shattering the leaves.

SPONTANEOUS COMBUSTION.

Crimson clover cures rather readily, and as a result spontaneous combustion of the hay is very rare. In one instance a farmer living near Brighton, Md., noticed smoke issuing from the center of his crimson-clover mow six months after the clover had been placed in the barn. The heating originated where the hayfork had dropped the bunches of hay and thus had thoroughly compacted the mass. The hay was somewhat damp when placed in the barn and apparently the combustion did not take place until most of the moisture had been eliminated. The barn and most of the hay were saved by cutting out, with a hay knife, the area surrounding the smoldering mass, and wetting each successive layer with buckets of water before it was removed to a near-by field. The hay was entirely black and showed numerous sparks here and there before being wetted down.

It is important that the hay should be free from external moisture, such as dew or rain, when placed in the barn, as this condition often causes it to develop heat. If the hay is not perfectly cured when placed in the barn, material changes sometimes take place without the hay mass taking fire. One instance was noted near Seaford.

Del., where the mowing away of hay which was too green resulted in the production of the so-called "brown hay," which, although unsightly in appearance, is usually greatly relished by stock.

FEEDING VALUE.

Crimson-clover hay is considered by dairymen to be fully equal, if not superior, to red or alsike clover as a roughage feed for their cows. The New Jersey Agricultural Experiment Station conducted a feeding experiment with milch cows which showed that crimson clover was worth \$16.55 per ton when substituted for wheat bran at \$26 per ton, for dried brewers' grains at \$20 per ton, or for mixed timothy and redtop hay at \$16 per ton. In addition to its value for milch cows, it is also an important constituent of the roughage feed of sheep, horses, mules, and other animals in the sections where it is grown. When grown in grain mixtures the resulting hay can be fed to advantage, especially to horses.

CRIMSON-CLOVER HAIR BALLS.

It is very important in cutting hay that it be cut before it has become mature, else the dry, ripened hairs on the stems and heads are likely to cause hair balls to form in the alimentary tracts of horses and mules. These hair balls are of a solid, compact, feltlike structure and nearly always cause death. The experience of a veterinarian of Dover, Del., has been that only one case out of about a hundred recovered. It is stated that often the horses affected are those belonging to newcomers in the crimson-clover district, especially those who are not familiar with the feeding of crimson clover or advised as to the proper stage to cut it for hay. Much less trouble is experienced by those who are accustomed to feeding it, since they do not feed it in large quantities but in mixture with other hay and are careful to cut it before it has passed the stage of full bloom. If the hay is sprinkled with water 12 hours before feeding, the danger of hair-ball formation is said to be considerably reduced. The danger is also greatly reduced if other hay or roughage be fed with the crimson clover. Occasionally, however, horses which have been fed judiciously as long as 10 or 12 years have become stricken with this complaint. Figure 4 shows two hair balls taken from different horses. Ordinarily, horses and mules only are affected with these hair balls.

CRIMSON CLOVER AS A SOILING CROP.

The ability of crimson clover to make its growth very early in the spring brings it to the stage where it can be cut and fed green to cattle at a time when most other green growth is just starting.

Usually crimson clover may be cut and fed green to the stock for a period of two to five weeks, especially if the early or late maturing varieties be utilized in connection with the ordinary variety. The fact that all roughage is likely to be scarce in the spring makes crimson clover, in the sections where it succeeds, an especially valuable addition to the list of forage crops on the farm.

CRIMSON CLOVER AS PASTURE.

Crimson clover furnishes earlier pasture than any other of the clovers. As a pasture crop it comes on after rye and before the red-clover pasture is available. When there are two fields on the farm



FIG. 4.—Crimson-clover hair balls taken from horses which had died from the presence of these masses in the alimentary tracts. The larger one is the largest of six taken from a horse which had been fed on crimson-clover hay for 12 years before his death. Horses have died within a few months after commencing to eat crimson clover. The smaller hair ball is as large as a regulation baseball.

which may be successfully pastured it is sometimes possible to get as much as eight weeks of spring pasturage from crimson clover. (See fig. 5.) This permits the ordinary pastures to develop a good growth of grass before it is necessary to turn the cattle upon them. The remaining portions of the clover plants, as well as the droppings, are usually plowed under shortly after the cattle are removed, and this makes a very good preliminary treatment for the succeeding crop. One instance was noted near Salisbury, Md., where a dairyman with 40 cows pastured them for three weeks on 3 acres of crimson clover. He then pastured the same 40 head on 7 acres for six weeks, feeding in addition a daily ration of 4 quarts of bran.

Crimson clover is only occasionally pastured in the fall. A light pasturing then with sheep or calves induces it to stool out better than is the case when the fall growth is not pastured. From Virginia southward the open winters make possible considerable winter pasturing with calves and hogs. Heavy stock should not be pastured on fields when the ground is soft and muddy.

Milk cows have been observed to make more milk when pastured on crimson clover than when pastured on red clover or alsike clover. Crimson clover may also be pastured with horses and pigs. The only drawback to its utilization as pasture is the fact that its season is comparatively short, not extending beyond two months in the spring. Pigs, sheep, calves, and chickens may, however, obtain considerable pasturage during the fall and open winter months.



FIG. 5.—Cows pasturing on crimson clover. The clover in the immediate foreground has been cut and fed green to other stock.

Cattle are somewhat subject to bloating if pastured on crimson clover that is wet with rain or dew. They are not, however, troubled to the extent that they are when pastured on either red clover or alfalfa.

CRIMSON CLOVER AS A SOIL IMPROVER.

When a crop of crimson clover is turned under a large quantity of humus and fertilizing material is added to the soil. This is especially true when all of the crop is plowed under as green manure. Often, however, the field is left standing for hay or seed, thus leaving only the stubble and roots in the field. (See fig. 6.) The stubble and roots appear in many cases, however, to be almost as effective in soil improvement as is the plowing under of the entire crop, except where the soil is rather low in humus. When the crop is cut, about

40 per cent as much nitrogen is returned to the soil as when the entire plant is plowed under. A full crop of crimson clover with a green weight of roots and tops of about 10 tons per acre is ordinarily regarded as equivalent in its effects to an application of fresh barnyard manure at the rate of about 8 tons per acre. This estimate seems justified by the relative composition of the clover plants and the manure. A ton of fresh manure ordinarily contains about 7.8 pounds of nitrogen and 500 pounds of dry matter, as compared with about 8.8 pounds of nitrogen and 370 pounds of dry matter per ton of green crimson clover. When the clover is plowed under the soil has really gained only in humus and in the nitrogen abstracted from the air by the nodule-forming bacteria on the roots of the clover. The soil gains, on the other hand, in potash and phosphorus as well



FIG. 6.—Plowing under crimson clover and grain stubble. The haystacks are to be seen in the background. The dark strip in the center was occupied the previous fall by corn shocks.

as in nitrogen and humus when the manure is applied and, consequently, ton for ton the manure would appear to be somewhat more valuable than the crimson clover. When crimson clover is seeded fairly early it will accumulate nearly half of its final quota of nitrogen before winter and after most other crops have ceased their growth. It also resumes its growth very early the following spring, so that it is out of the way in time for the regular spring-seeded crops. This characteristic makes it of special value in the economic maintenance of soil fertility, since it is possible to grow a money crop, such as corn, cotton, or tomatoes, each summer and at the same time turn under each year either the stubble or the entire crop of crimson clover. It has been found most desirable to commence plowing under the crimson clover at least a week or 10 days before it commences to

bloom. This gives three or four weeks for the plowing under of the crop and for the preparation of the ground for the spring-seeded crops. For early-planted truck crops it is often desirable to turn under the crimson clover when it is only half or two-thirds grown, as the ground at that time is likely to be much less cloddy from baking than if the plants are left until they are nearly or quite in bloom.

Not only is nitrogen in a very available form added to the soil, but the nitrogen, phosphoric acid, and potash already in the soil are caught and kept from leaching during the winter. The phosphoric acid and potash are thought to be rendered more available to the subsequent crops by this process.

The physical condition of the soil is also materially benefited by the growth of crimson clover. The sandy soils are increased in humus, thus being made more retentive of moisture. On the other hand, the stiff, heavy clay soils are rendered more open and friable. Even if the crimson clover be winterkilled, there is usually enough fall growth available as a source of soil fertility the following spring to more than pay for the cost of establishing the stand.

It is generally considered that a bushel of crimson-clover seed sown on 4 acres of ground will increase the succeeding yield of corn about the same amount as would a ton of complete fertilizer applied at the rate of 500 pounds per acre on 4 acres of similar land. The relative increase of such a crop as corn is greater on poor land than on fields already capable of producing good crops. If the land in question is so poor as to bring only 10 or 15 bushels of corn per acre, a good stand of crimson clover turned under will ordinarily double the yield. To obtain a satisfactory stand of the clover on such poor land, however, manure or commercial fertilizers, and often lime, must be applied. A part of the increased yield of the subsequent corn crop must be credited to the residual effect of the fertilizer used in connection with the crimson clover. On land that will make 30 bushels of corn per acre a yield of 45 bushels may ordinarily be expected following crimson clover. On land richer than this an increase of more than 10 bushels per acre is uncommon. A specific instance may be mentioned in the case of J. B. Watkins & Bro., of Midlothian, Va., whose farm is a shallow sandy loam with a clay subsoil. This soil was badly run down and was not producing more than 12 to 15 bushels of corn per acre. About 300 pounds of bone meal were broadcasted when the clover was first seeded on fallow land. The following spring a part was cut for hay and the rest turned under. The entire field was then put in corn, and each summer for nine years crimson clover was seeded in the corn at the last working. The yield from a measured acre the ninth year was 55 bushels. The portions from which a crop of hay was cut annually gave yields of corn essentially the same as where the entire crop was plowed under.

CRIMSON CLOVER AS A COVER CROP.

Crimson clover in sections where it succeeds is regarded as a most satisfactory cover crop on soils which would otherwise be left bare

during the winter. (See fig. 7.) It is especially valuable in orchards, where it is generally plowed under as a green-manure crop. Its rapid growth during the autumn reduces the moisture and, to some extent, the plant-food content of the soil. This induces the trees to stop growing earlier in the autumn and to ripen their wood well in advance of cold weather, thus rendering them less susceptible to winter injury. The plants retain for the use of the trees the following season much of the plant food which would otherwise leach out of the ground during the winter and early spring. A good stand of crimson clover not only reduces erosion and the gully-



FIG. 7.—Crimson clover as a cover and green-manure crop. The clover on the left has been turned under to act as green manure.

ing of the fields, but on sandy fields the blowing of the soil by the wind is greatly lessened. The plants also serve to hold the snow to a greater extent than if the field was left bare during the winter.

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